FLO•WING®
PATENT PENDING METER

PRODUCT MANUAL

PRODUCT OF

ENERGYNEERING® SOLUTIONS INC

ISCO INDUSTRIES

Contents:

Overview.....2

Design Advantages.....2

Sizes.....2

Available Options.....2

Flow Rate Reference Curves.....3

Available Wellheads.....4

Popular Custom Options.....4

- Polygate™-HDPE Gate Valve
- Spears Gate Valve Upgrade
- PVC Union
- Flange Connections
- Custom Fabricated Pump Wellheads

Additional Packages.....5

- Fernco Connection Package
- Kanaflex/Power Lock Connection Package
- Vertical Wellhead Centralizing Support

Installation Options.....6

Installation Procedures.....6

- Fernco Connection Package
- Kanaflex/Power Lock Connection Package
- Vertical Wellhead Centralizing Support

Instruments Commonly Used to Sample Wells.....8

Contact Information.....8

Flo-wing® User Guide

Overview:

Developed by ENERGYneering Solutions Inc.® to overcome the challenges of current wellhead technology, the Flo-Wing® Meter provides landfill operators the widest measurement range, unobstructed liquid passage and varied placement options. These attributes result in reduced maintenance costs, reduced facility down-time and increased confidence in flow measurement. Accuracy has been proven through calibration by Flow Dynamics Inc., Elkins Earthworks, the mechanical engineering department of George Fox University, and through field testing at landfill sites around the country. The Flo-Wing® Meter is compatible with any of today's commonly used monitoring instruments. ESI is flexible in their manufacturing process to include a variety of custom options to best fit your application and save valuable field assembly time. The second generation of Flo-Wing® inserts are molded from Royalite thermoplastic, "a rigid, fire-rated [PVC/acrylic] alloy which combines very high impact strength, good abrasion resistance, stiffness and hardness with excellent formability and exceptional chemical resistance" (Spartech Plastics).

Design Advantages:

- Wide flow measurement
- Horizontal and vertical placement
- Unobstructed liquid passage
- Reduced maintenance and downtime
- Accurate flow measurements

Sizes:

	1" (Model #180)	2" (Model #264)	3" (Model #360)
Recommended Flow Measurement Range	0 to 10 scfm	3 to 120 scfm	100 to 300 scfm
Equivalent Orifice Size for use with GEM®	0.55 in.	1.30 in	2.10 in
Pipe ID	0.92 in	1.91 in	2.86

Available Options:

- Piping Materials – PVC, HDPE
- Configurations – Vertical Wellhead, Horizontal Wellhead, Meter Run, or
- Custom Options – Valve Options, Flanges, Unions, Fernco® Fittings, Kanaflex® Hose & Clamps, Centralizing Supports and Accessories.

Flow Rate Reference Tables:

For those who prefer to measure flow using a manometer or differential pressure gauge.

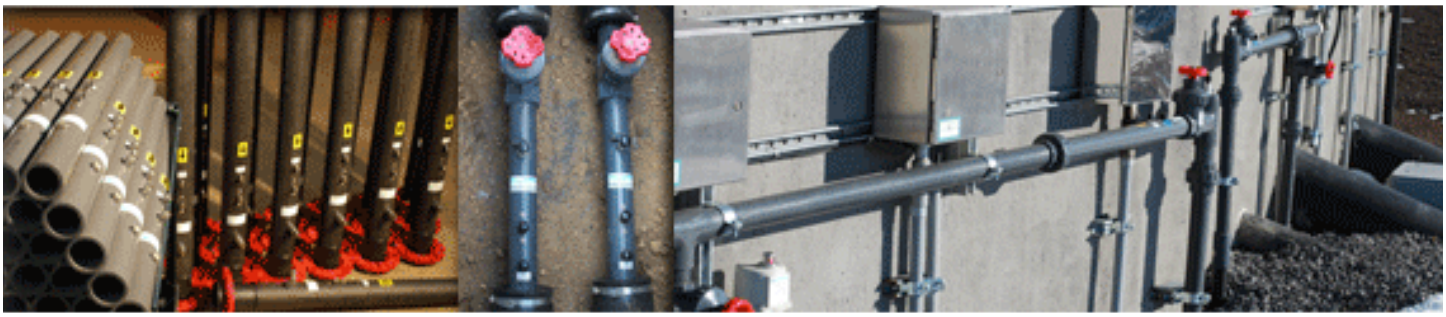
FLO-WING 1" (Model #180)			
Diff. Pressure (inH2O)	*Flow Rate (SCFM)*	*Diff. Pressure (inH20)*	*Flow Rate (SCFM)*
0.01	0.38	6.50	9.69
0.02	0.54	7.00	10.05
0.03	0.66	7.50	10.40
0.04	0.76	8.00	10.75
0.05	0.85	8.50	11.08
0.10	1.20	9.00	11.40
0.20	1.70	9.50	11.71
0.40	2.40	10.00	12.01
0.60	2.94	10.50	12.31
0.80	3.40	11.00	12.60
1.00	3.80	11.50	12.88
1.20	4.16	12.00	13.16
1.40	4.50	12.50	13.43
1.60	4.81	13.00	13.70
1.80	5.10	13.50	13.96
2.00	5.37	14.00	14.22
2.20	5.64	14.50	14.47
2.40	5.89	15.00	14.71
2.60	6.13	15.50	14.96
2.80	6.36	16.00	15.20
3.00	6.58	16.50	15.43
3.20	6.80	17.00	15.66
3.40	7.01	17.50	15.89
3.60	7.21	18.00	16.12
3.80	7.41	18.50	16.34
4.00	7.60	19.00	16.56
4.20	7.79	19.50	16.78
4.40	7.97	20.00	16.99
4.60	8.15	20.50	17.20
4.80	8.32	21.00	17.41
5.00	8.50	21.50	17.62
5.20	8.66	22.00	17.82
5.40	8.83	22.50	18.02
5.60	8.99	23.00	18.22
5.80	9.15	23.50	18.42
6.00	9.31	24.00	18.61

FLO-WING 2" (Model #264)			
Diff. Pressure (inH2O)	*Flow Rate (SCFM)*	*Diff. Pressure (inH20)*	*Flow Rate (SCFM)*
0.01	2.8	6.50	72.1
0.02	4.0	7.00	74.8
0.03	4.9	7.50	77.5
0.04	5.7	8.00	80.0
0.05	6.3	8.50	82.5
0.10	8.9	9.00	84.9
0.20	12.7	9.50	87.2
0.40	17.9	10.00	89.5
0.60	21.9	10.50	91.7
0.80	25.3	11.00	93.8
1.00	28.3	11.50	95.9
1.20	31.0	12.00	98.0
1.40	33.5	12.50	100.0
1.60	35.8	13.00	102.0
1.80	38.0	13.50	103.9
2.00	40.0	14.00	105.8
2.20	42.0	14.50	107.7
2.40	43.8	15.00	109.6
2.60	45.6	15.50	111.4
2.80	47.3	16.00	113.1
3.00	49.0	16.50	114.9
3.20	50.6	17.00	116.6
3.40	52.2	17.50	118.3
3.60	53.7	18.00	120.0
3.80	55.1	18.50	121.7
4.00	56.6	19.00	123.3
4.20	58.0	19.50	124.9
4.40	59.3	20.00	126.5
4.60	60.7	20.50	128.1
4.80	62.0	21.00	129.6
5.00	63.3	21.50	131.2
5.20	64.5	22.00	132.7
5.40	65.7	22.50	134.2
5.60	66.9	23.00	135.7
5.80	68.1	23.50	137.1
6.00	69.3	24.00	138.6

FLO-WING 3" (Model #360)			
Diff. Pressure (inH2O)	*Flow Rate (SCFM)*	*Diff. Pressure (inH20)*	*Flow Rate (SCFM)*
0.01	6.7	6.50	171.3
0.02	9.5	7.00	177.7
0.03	11.6	7.50	184.0
0.04	13.4	8.00	190.0
0.05	15.0	8.50	195.9
0.10	21.2	9.00	201.5
0.20	30.0	9.50	207.1
0.40	42.5	10.00	212.4
0.60	52.0	10.50	217.7
0.80	60.1	11.00	222.8
1.00	67.2	11.50	227.8
1.20	73.6	12.00	232.7
1.40	79.5	12.50	237.5
1.60	85.0	13.00	242.2
1.80	90.1	13.50	246.8
2.00	95.0	14.00	251.4
2.20	99.6	14.50	255.8
2.40	104.1	15.00	260.2
2.60	108.3	15.50	264.5
2.80	112.4	16.00	268.7
3.00	116.4	16.50	272.9
3.20	120.2	17.00	277.0
3.40	123.9	17.50	281.0
3.60	127.5	18.00	285.0
3.80	131.0	18.50	288.9
4.00	134.4	19.00	292.8
4.20	137.7	19.50	296.7
4.40	140.9	20.00	300.4
4.60	144.1	20.50	304.2
4.80	147.2	21.00	307.9
5.00	150.2	21.50	311.5
5.20	153.2	22.00	315.1
5.40	156.1	22.50	318.7
5.60	159.0	23.00	322.2
5.80	161.8	23.50	325.7
6.00	164.6	24.00	329.1

Available Wellheads

Flo-Wing® is pleased to offer a full line of PVC and HDPE landfill gas collection wellheads in a variety of sizes with countless custom options available. If there is any particular items that you would like included on your wellhead to best fit your application and save valuable field assembly time, we will happily work it in to our manufacturing schedule.



Popular Options

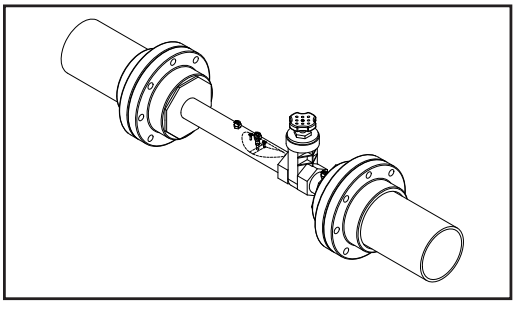
Polygate™-HDPE Gate Valve:

The Polygate™ Valve, designed and developed by ENERGYneering Solutions Inc.®, is an HDPE gate valve designed for use as a flow regulating device specifically for use in saturated gaseous, high particulate, high temperature, and low pressure environments such as in landfill gas wellfields and similar environments where particulate and water gathering can obstruct the operation of a typical gate valve.

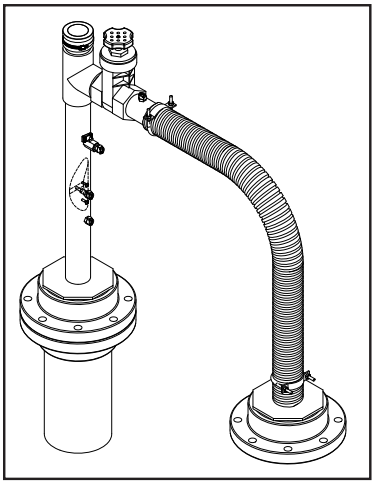
The Polygate™ Valve is designed to compliment the function of the Flo-Wing® wellheads.

PVC Union:

PVC union connections may be included if preferred for rapid disconnection/disassembly of the wellhead. Typically requested union locations are shown in following images. Alternate or additional union locations are also available upon request.



PVC union on Horizontal Wellhead



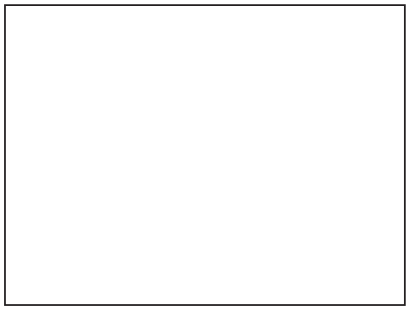
PVC union on Vertical Wellhead

Popular Options *cont.*

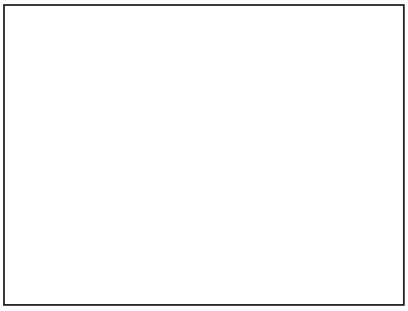
Flange Connections:

In an effort to save our customers valuable field assembly time when their application requires flanged connections, ESI is flexible to add any desired flanged connection to our wellheads and meter runs. PVC flanges provided are Van Stone Flanges. If the PVC flange connection size is larger than the wellhead pipe size, a PVC reducer bushing will be used. HDPE flanged connections consist of the corresponding HDPE flange adapter with ductile iron backup ring fusion welded in the location requested.

Flange Connection Packages Available upon request.



HDPE Flange



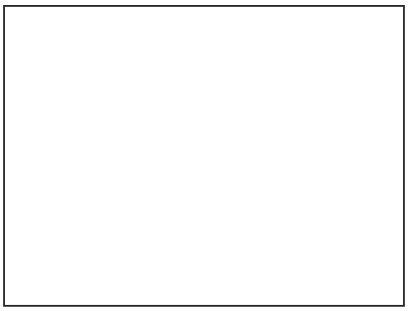
PVC Flange

Custom Fabricated Pump Wellheads:

Designed to minimize air incursion at high BTU sites while allowing for easy temporary or permanent installation of a pneumatic leachate/condensate discharge pump in the well, this custom wellhead is constructed entirely of fusion welded HDPE with flanged connections to eliminate the use of flexible couplings. This and other custom wellheads are available upon request from ESI. If you have an idea in mind that would best fit your application, let us know and we will work up a competitive price.

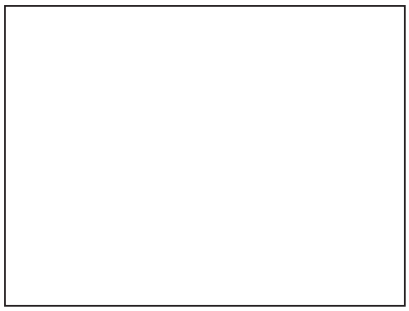
Custom Wellhead

Additional Packages:



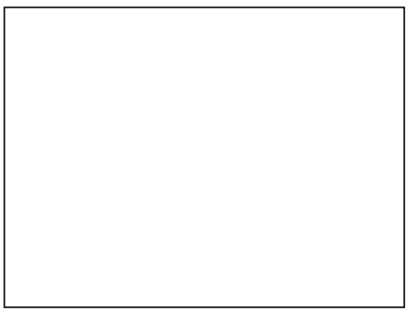
Vertical Wellhead Centralizing Support:

Centralizing supports are offered with the vertical wellheads to help prevent sagging or leaning in any one direction. They are constructed of stainless steel and are available in various sizes that fit most wells..



Kanaflex/Power Lock Connection Package:

Kanaflex and Power Lock Connection packages can be provided per customers request.



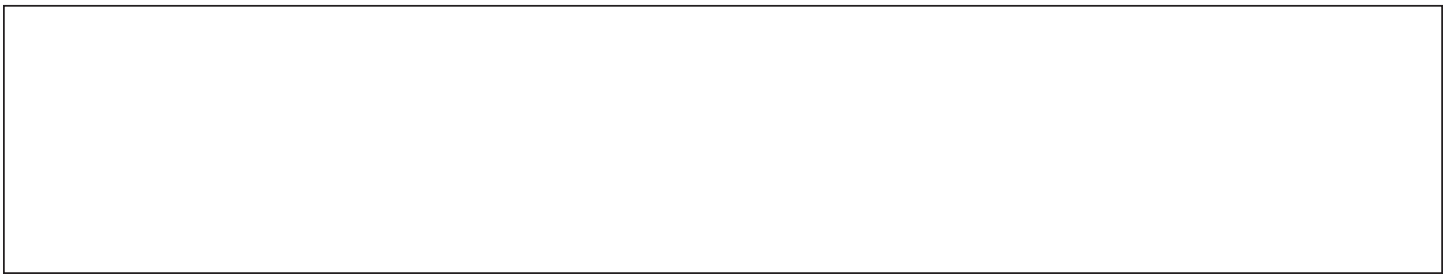
Fernco Connection Package:

Fernco also provides wellhead packages with any desired Fernco fittings.

Flo-Wing Installation Procedure:

Placement

The placement and parts configurations should be determined and prepped before the installation process begins.



Placement and Configuration examples

Securing

Make sure all items are secure and sealed before applying vacuum to the wellhead.

Vertical Well Installation

• ***Slip or Mechanical End Vertical Well Casing***
(see image ___)

1) Take a measurement of the vertical well casing's outer diameter (O.D.)

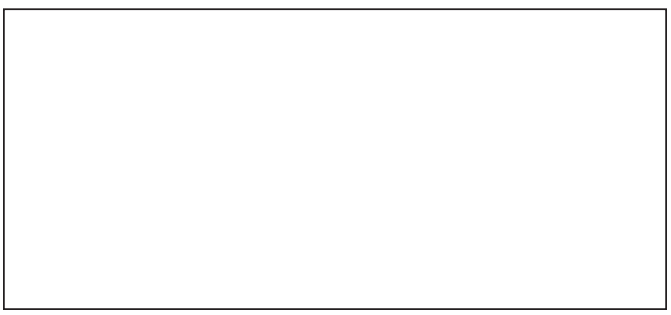
2) Determine what adapter kit works best for your application. Make sure you have the correct diameter adapter kit to fit the diameter of the well casing. Generally a coupling, reducer bushing, and associated clamps are necessary items. A vertical well centralizer is available as shown above to add support, and to prevent sagging or leaning.

3) Combine the Flo-Wing® wellhead assembly, coupling, and reducer bushing to make sure they will fit correctly over the well casing.

4) Loosen the clamps around the flexible coupling and slide the coupling over the plain end of the well casing.

5) Slide the reducer bushing to the desired location on the Flo-Wing® wellhead assembly. .

6) Place the wellhead assembly into the well casing. Once it is oriented in the desired direction slide the reducer bushing and wellhead assembly into the coupling on the top of the well casing. Tighten the coupling's clamps to the appropriate torque.



• ***Flanged Vertical Well Casing*** (see image___)

1) Take a measurement of the vertical well casing's outer diameter (O.D.)

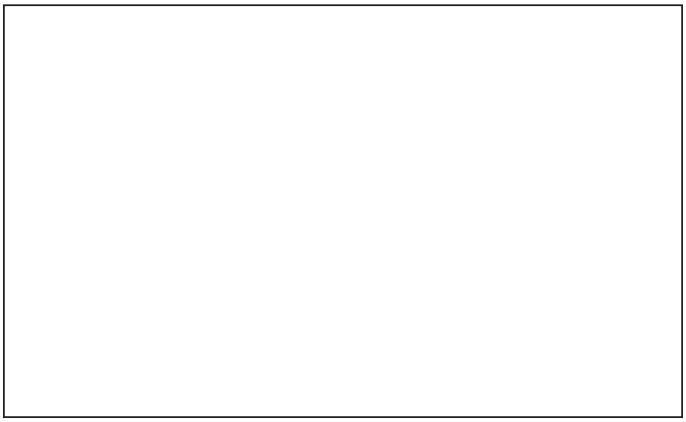
2) Determine what flanged adapter kit works best for your application. Make sure you have the correct diameter adapter kit to fit the diameter of the well casing.

3) Combine the wellhead casing's flange and back-up ring with the flanged Flo-Wing® wellhead assembly to determine that they fit together and will work with the given well casing.

4) Place the appropriate gasket (neoprene) onto the wellhead casing flange.

5) Place the flanged Flo-Wing assembly onto the flanged well casing. Make sure the gasket is positioned correctly.

6) Slide bolts threw the back-up rings and tighten. Be careful not to over-tighten.



Flo-Wing Installation Procedure:

Horizontal Well Installation

• ***Slip or Mechanical End Vertical Well Casing***
(see image ___)

1) Take a measurement of the vertical well casing's outer diameter (O.D.)

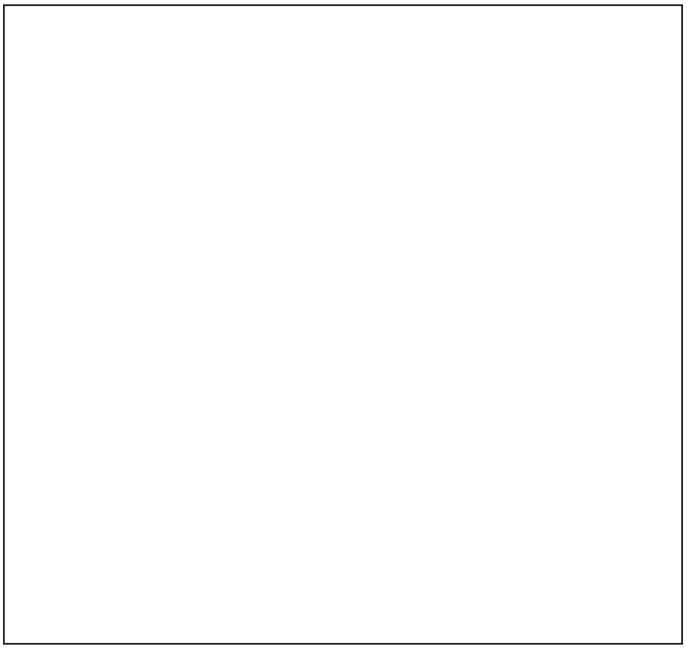
2) Determine what adapter kit works best for your application. Make sure you have the correct diameter adapter kit to fit the diameter of the well casing. Generally a coupling, reducer bushing, and associated clamps are necessary items. Horizontal applications may use slip or mechanical fittings on both ends of the wellhead assembly.

3) Combine the Flo-Wing® wellhead assembly, coupling, and reducer bushing to make sure they will fit correctly over the well casing. Depending on the application this may need to be done on both ends of the wellhead assembly.

4) Loosen the clamps around the flexible coupling and slide the coupling over the plain end of the well casing. Do one side before the other.

5) Slide the reducer bushing to the desired location on the Flo-Wing® wellhead assembly.

6) Place the wellhead assembly into the well casing. Once it is oriented in the desired direction slide the reducer bushing and wellhead assembly into the coupling on the top of the well casing. Tighten the coupling's clamps to the appropriate torque.



• ***Flanged horizontal well casing*** (see image___)

1) Take a measurement of the vertical well casing's outer diameter (O.D.)

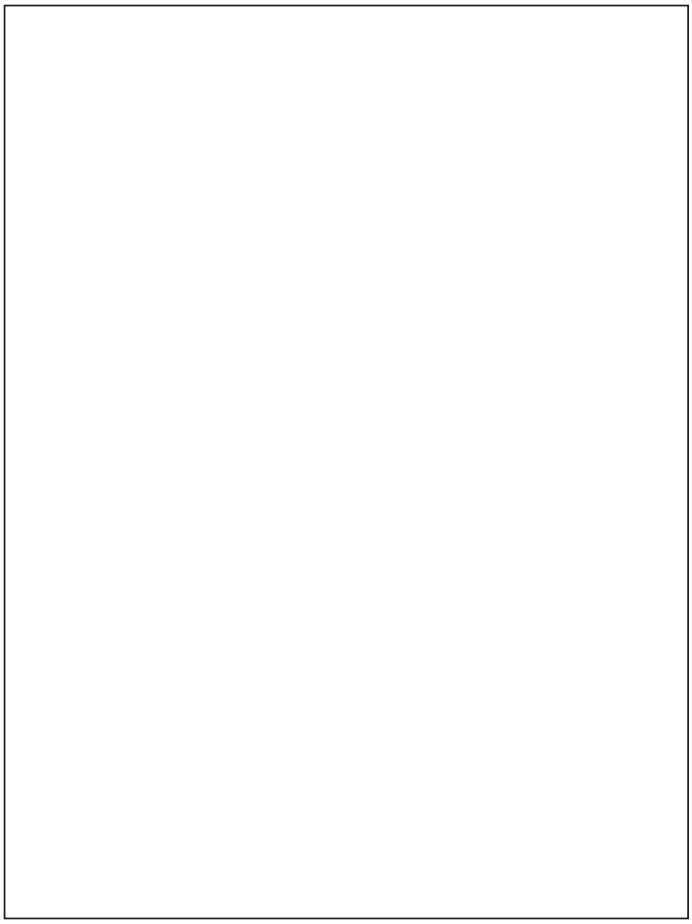
2) Determine what flanged adapter kit works best for your application. Make sure you have the correct diameter adapter kit to fit the diameter of the well casing.

3) Combine the wellhead casing's flanges and back-up rings on either end with the flanged Flo-Wing® wellhead assembly to determine that they fit together and will work with the given well casing.

4) Place the appropriate gaskets (neoprene) between the wellhead casing flange and the Flo-Wing® wellhead assembly.

5) Place the flanged Flo-Wing® assembly between the flanged well casings.

6) Slide bolts threw the back-up rings and tighten. Be careful not to over-tighten.



Use and Monitoring:

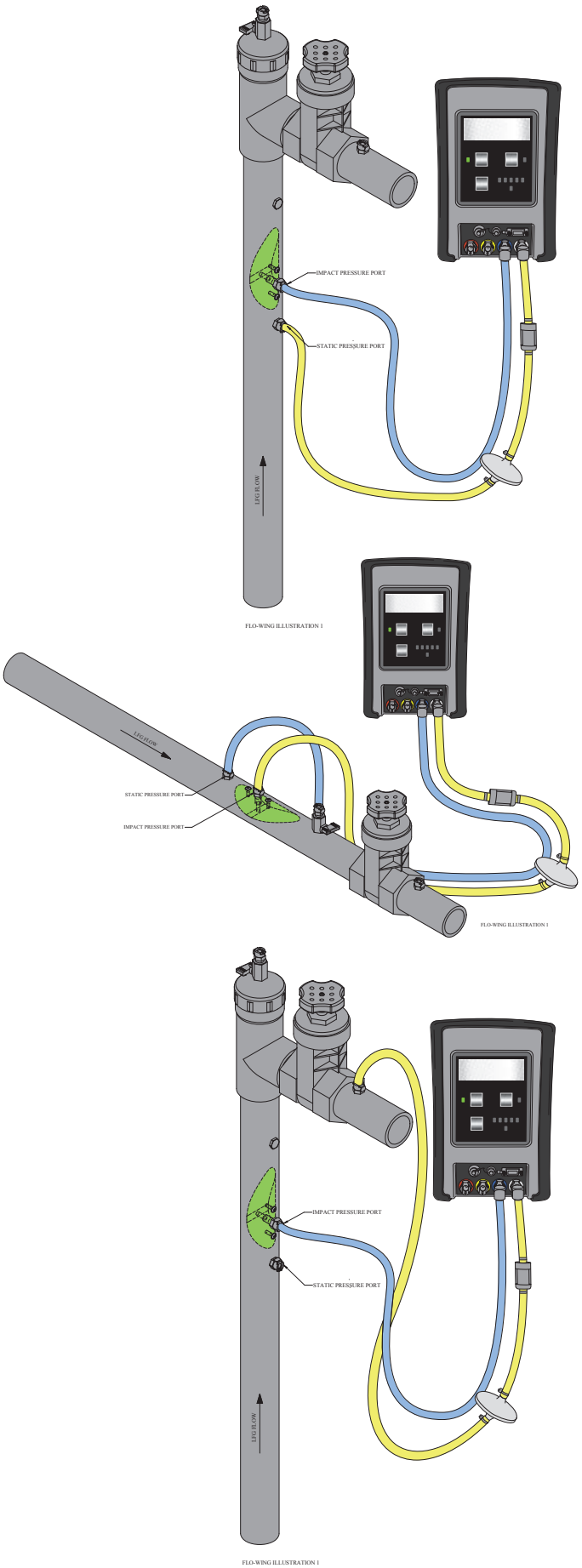
1. Regardless of the equipment you are using, make sure the instrument is properly calibrated. Pepare the instrument for sampling by allowing it to properly warm up as directed by the manufacturer.

2. Connect the instrument to the wellhead and begin collecting a sample. When using a Flo-wing wellhead this is correctly done by connecting the sample hose on the gas analyzer to the static pressure port labeled on the wellhead.
Now the impact line on the analyzer should be connected to the differential port on the wellhead.

3. Continue collecting the sample with the pump running until the reading stabilizes. A stable reading is one that does not vary more than 0.5% by volume on the instruments scale.

4. Record wells temperature. This is generally done with a digital thermometer attached to the gas analyzer, but can also be recorded with a standard dial thermometer insetered into the wellhead.

5. Record system side vacuum if available. This is taken from the sample port downstream of the gate valve when available.



Instruments Commonly Used to Sample Wells

Envision Meter

The user manual for the Elkins Earthworks Envision Meter can be found and downloaded at the following link. http://www.elkinsearthworks.com/Content.aspx?Page=408b9189-6ed7-45cf-b351-102519d54b86.

Copyright © Elkins Earthworks 2011

To make the Envision Meter compatible with reading Flo-wing wellheads a few changes need to be made to the software that comes from the Envision Meter.

Gem

The user manual for the GEM 500, GEM 2000, GEM 2000+, and GEM 5000 can be found and downloading at the following link. http://www.landtecna.com/Product.aspx?ID=8&CategoryID=1

To make GEM units compatible with reading Flo-wing wellheads equivalent orifice plate sizes are needed.

Copyright © 2009 LANDTEC North America

	1" (Model #180)	2" (Model #264)	3" (Model #360)
Recommended Flow Measurement Range	0 to 10 scfm	3 to 120 scfm	100 to 300 scfm
Equivalent Orifice Size for use with GEM	0.55 in.	1.30 in	2.10 in
Pipe ID	0.92 in	1.91 in	2.86

Contact Information

For more information, assembly options, or installation suggestions including HDPE packages contact Flo-Wing® or ISCO offices at the following :

ENERGYneering Solutions Inc.®
Phone 541.549.8766
www.ENERGYneeringSolutions.com

Andy Rodgers
ISCO Industries
Phone: 502.714.5323

Flo-Wing®
www.flo-wing.com